

The Effects of Numeracy and Brand Preference on the Left-Digit Effect

Honors Research Thesis

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by

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Abstract

A left-digit effect (LDE) is said to occur when a change in the left-most digit of a value (e.g., when \$4.00 drops to \$2.99 versus when it drops from \$4.01 to \$3.00) significantly increases consumer judgments of the price difference. Thomas and Morwitz (2005) showed that it was the change in the left-digit, rather than the one-cent drop, that affects these perceptions. This effect has domain invariance, meaning the left-digit effect manifests not only in prices, but also in other types of nine-ending numbers (Thomas & Morwitz, 2005). The finding has important implications for pricing practices.

The present study examined whether individual differences in numeracy or affective information based on brand preference influence the left-digit effect. Peters et al. (2006) defined numeracy as the ability to use and understand basic probability and mathematical concepts. People range widely in their ability to use numbers, and the highly numerate encode numeracy and non-numeric information differently than the less numerate when making decisions. We predict that numeracy ability along with brand preference can help negate the left-digit effect and lead to better magnitude perceptions. Using a modification of the experimental paradigm from Thomas and Morwitz, we showed participants two 12-packs of soda that either have a brand name (Coke and Pepsi) or are generic (the control condition). Subsequently, subjects stated their preference between the sodas (e.g., ranging from strongly prefer Coke to strongly prefer Pepsi in the experimental condition). Subjects then took an eight-question math test to assess their numeracy ability (Weller et al., 2012). Results indicated that overall more numerate individuals paradoxically showed larger LDEs. Participants did not show significantly larger LDEs when brand names were used versus when they were not.

The Effects of Numeracy and Brand Preference on the Left Digit Effect

Introduction

Could a one-cent difference in price really influence consumer's purchasing behavior? This question has been mulled over by researchers from as early as 1932. At first glance, conventional wisdom suggests people would not be influenced by a change in one cent. However, the act of changing a price from having a nine-ending to a zero-ending (e.g., \$3.99 to \$4.00) can have a substantial effect on a consumer's willingness to buy. This idea, known as the left-digit effect, occurs when a one-cent difference changes the left-most digit of a price (e.g., going from \$3.99 to \$4.00) and this change affects magnitude judgments (Thomas & Morwitz, 2005). A magnitude judgment is simply the perceived difference between two prices. A larger magnitude judgment means a larger perceived discrepancy between the two prices. Thomas and Morwitz (2005) tested the left-digit effect with consumers considering the prices for four pens. Each participant saw prices for four generic pens. One pen was the comparison pen and was always priced at \$4.00. The price of the remaining pens varied. Half of the participants saw pens that ended in the digit nine (\$2.99 and \$3.59) and the other half saw pens with a zero ending price (\$3.00 and \$3.60). These pens were called target pens. Thomas and Morwitz were interested in magnitude perceptions of the target prices. Participants would rate on a scale from one to five how expensive they thought the target pens were. They found that participants rated the pen priced at \$2.99 to be significantly less expensive than participants rating the \$3.00 pen. This finding has been replicated in subsequent research (Manning & Sprott, 2009). The replication of this finding and previous research leads to our first hypothesis:

H1: Individuals will be more sensitive to price differences when there is a left-digit effect. We will replicate the findings from Thomas and Morwitz (2005) and Manning and Sprott (2009).

Although the left-digit effect has been replicated in other studies, no research has been conducted to see whether or not individual differences such as numeracy or other outside information such as the presence of brand names. The present study focuses on exactly these effects.

Higher numeracy, in particular, is expected to be associated with improved magnitude judgment. Numeracy is defined as the ability to use and understand basic probability and mathematical concepts (Peters et al., 2006). People differ substantially in numerical ability. According to the data in the National Literacy Survey, half of Americans cannot accurately understand numbers that are embedded in print materials such as newspapers (Kirsch et al., 2002). This disparity in numeracy ability is discouraging because making good decisions in many real world situations requires numerical ability (Peters et al., 2006). For example, greater numeracy was associated with more accuracy in making judgments about probabilities associated with prostate cancer screening (Hamm, Bard & Scheid, 2003). Overall, the inability to deal rationally with small likelihoods of large outcomes appears to lead to misinformed government policies, confused personal decisions, and an increased susceptibility to pseudo-science. Innumeracy may be a critical obstacle for making good decisions or judgments in many domains.

For instance, Peters et al. (2006) showed participants exam scores of five psychology students. In one condition, participants saw that a student got 74% correct, whereas in the other condition participants saw that the student got 26% incorrect. These are logically identical

scores; however one is framed negatively (percent incorrect) and one is framed positively (percent correct). Participants were then asked to rate on a scale from -3 to +3 on how well each student performed. Less numerate individuals were more influenced by the framing of the exam scores. They rated the students as doing much more poorly than the highly numerate did when a negative frame than a positive frame was shown to the participants.

The way numeric data are formatted (in percentage versus frequentistic terms) also can influence a less numerate individual's judgments. In a second study by Peters et al. (2006), participants were shown a situation and later were asked to assess the level of risk ranging from 1 (low) to 6 (high). Participants in the frequency condition were told: "Of every 100 patients similar to Mr. Jones, 10 are estimated to commit an act of violence to others during the first several months after discharge." In the percentage condition, instead of 10 out of 100, it said 10%. Both highly numerate and less numerate individuals rated the risk as being medium when presented in the frequency frame, but the less numerate individuals rated the risk significantly lower in the percentage frame. One explanation for this is that the less numerate individuals are influenced by the affective nature of the frequency format. They can easily picture 10 people being violent, whereas it is much more difficult for them to visualize 10% in an affective way; instead, it is a small, abstract number. The results provide initial evidence that less numerate individuals can be swayed more by affective information.

A second explanation is that the more numerate are able to transform numbers and probabilities. When given a percentage frame (e.g. 20%) a more numerate individual is able to transform this into a frequentistic frame (e.g. 20 out of 100). The less numerate are only capable of viewing the information in the frame presented to them (Peters et al., 2006). It is conceivable that this could translate to prices as well. A more numerate individual may transform \$2.99 to

\$3.00 and not be influenced by the left-digit effect. All of this information leads to our second hypothesis:

H2: The more numerate individuals will not show the left-digit effect and will make better magnitude judgments. It is possible that the more numerate are able to transform \$2.99 to \$3.00 and will not be susceptible to the left-digit effect.

Brand Attachment

One source of affective information is brand. A brand is defined as a name, symbol, design, or mark that enhances the value of a product beyond its functional value (Farquhar, 1989). Businesses and consumers are much more willing to pay for brand name products because brand names are perceived to add value (Cobb-Walgren et al., 1995). Companies spend millions of dollars to bring a new brand to market. It is estimated that it costs approximately \$100 million to do so (Ourusoff, 1992) and there is a fifty percent probability of the brand failing (Crawford, 1993). Companies are willing to take risks and pay millions of dollars on brands in an effort to create brand equity, which is the added value that a brand name gives a product (Aaker, 1991). Brand equity can be measured in a variety of different ways, but each method tends to fit either in two categories, financial or consumer related. Sullivan and Simon (1993) used a financial measure of brand equity, as they looked at movements in stock prices. They theorized that the fluctuations of stock prices are a good indicator of future prospects for brands. Mahajan, Rao and Srivastava (1991) used another financial measure as they used the potential value of brands to an acquiring firm as an indicator of brand equity. Brand equity can also be viewed from a consumer related perspective. A consumer related perspective takes an approach of defining brand equity by considering aspects of consumer behavior such as brand loyalty and

willingness to pay a higher price (Cobb-Walgren et al., 1995). One approach to view brand equity in such a way is used by several authors. These authors treat brand equity as brand name importance, since the name of the brand is often its core indicator (Louviere and Johnson 1988; Yovovich 1988; Sharkey 1989; MacLachlan and Mulhern 1991). The importance of brand equity is that it can lead to customer loyalty and perhaps eventually brand attachment.

Brand attachment or preference is defined as the strength of the bond connecting the brand with the self (Park et al., 2010). According to Park et al. (2010), emotions are often evoked when brand strength is strong. People feel a connection to the brand and these emotions tie them to the brand. These emotions could have an interesting interaction with numeracy, as mentioned earlier, in that less numerate individuals tend to rely more on affective and emotional information rather than numerical data. Park et al. (2010) showed that the more strongly individuals are attached to a brand, the more willing they would be to forego personal resources to obtain a relationship with the brand or to continue purchasing products from a particular brand name. When Thomas and Morowitz (2005) first studied the left-digit effect, participants judged magnitude differences for generic products without any brand names. When no brand name is present, we expect the results to be very similar to Thomas and Morowitz (2005), which leads to our third hypothesis:

H3: When no brand name is present, individuals will show the left-digit effect and will be sensitive to price change.

However, when brand names are present we expect different results from Thomas and Morowitz (2005). The present study uses products, Coke and Pepsi, that have very strong brand equity and attachment. Coke has enjoyed a relatively stable market share over the years that has remained

around sixty percent (Fruchter & Kalish, 1997). A high market share combined with the fact that Ohio State University is a Coke campus (only Coke is allowed to be sold in dining halls and other parts of campus) it is reasonable to assume that Coke has strong brand attachment among Ohio State students. With a strong attachment to the product, the affective component of the brand could have an interesting influence on a consumer's intent to purchase. This is something that Thomas and Morwitz did not take into account in their study and leads to our fourth and final hypothesis:

H4: When brand names are present and the subject has a strong preference, the subject will pay less attention to the price and more to the brand. This will lead to a smaller left-digit effect when brand name is present versus when it is not.

Method

Participants

A total of 424 undergraduate students from The Ohio State University's REP research pool completed the between- and within-subjects experiment for course credit. Participants were randomly assigned to one of two conditions: brand (Coke and Pepsi) and no brand (Brand A and Brand B).

Design

This study employed a 2 x 2 x 2 mixed factorial design. The effect of the nine ending (nine vs. zero) was examined between subjects while the effect of the left digit (same vs. different) was within subjects on judgments of 12-packs of soda. The stimuli for this experiment were 12-packs of soda and each participant saw prices for two pairs of 12-packs of soda. Half of

the participants assessed items with brand names present (Coke vs. Pepsi) and the other half saw items that were generic (Soda Brand A vs. Soda Brand B). To control for some participants who only drink diet soda, prior to the task, participants were asked if they preferred diet or regular soda. If they selected diet, then the stimuli presented to the participants were Diet Coke (Diet Soda Brand A) and Diet Pepsi (Diet Soda Brand B). Coke (Brand A) was the comparison price (always priced at \$4.00) and Pepsi's (Brand B's) price varied between conditions. Half of the participants saw Pepsi with a nine ending (\$2.99 and then \$3.59) and the other half saw Pepsi with a zero ending (\$3.00 and then \$3.60). The pricing scheme was the same in the diet soda condition; Diet Coke (Diet Soda Brand A) was the comparison price and Diet Pepsi (Diet Soda Brand B) was the target price. The dependent variable was the preference for the different 12-packs, ranging from very likely to purchase Coke (Brand A) to very likely to purchase Pepsi (Brand B).

Procedure

To control for the fact that some people strictly drink diet or regular soda, participants were asked to identify which type they typically prefer. Based on their response, they were placed in either the diet or regular soda condition. The pricing and wording of the questions were the same in both conditions; the only difference was that the participants in the diet soda condition saw stimuli that were diet and participants in the regular condition saw stimuli that were regular. The stimuli presented to the participants in both conditions are listed in Appendix A. The remainder of the text, however, will mention only Coke and Pepsi and will omit mention of Diet Coke and Diet Pepsi (and generic diet sodas in the control conditions) for simplicity of presentation.

Participants were instructed to imagine being at a grocery store in the soda aisle. Participants saw 12-packs of Coke and Pepsi if they were in the experimental condition or 12-packs of Soda Brand A and Soda Brand B if they were in the control. They were asked, based on their listed prices, how likely they would be to purchase Coke (Brand A) or Pepsi (Brand B) on a six-point Likert scale. The options ranged from 1 (*very likely to purchase Coke*) to 6 (*very likely to purchase Pepsi*). After making a selection, participants were told to imagine being at a second grocery store in the soda aisle. The prices of the soda at the second grocery store were different from the first. In the first grocery store, Coke (Brand A) was always priced at \$4.00 and the price of Pepsi (Brand B) was either \$2.99 if the participant is in the nine-ending condition or \$3.00 if the participant is in the zero-ending condition. At the second grocery store Coke (Brand A) was still \$4.00 and Pepsi was now either \$3.59 or \$3.60 based on what condition the participant was in. Using the same Likert scale as the first scenario, participants were asked to make a selection. After this question participants were asked some filler questions such as, “how many cans/servings of soda do you drink per week?” The full list of questions is included in Appendix B. After the filler questions, participants were asked to state their preferred soda, either Coke or Pepsi, when the sodas were priced the same. They rated their preference on a five-point Likert scale with options ranging from 1 (strongly prefer Coke) to 5 (strongly prefer Pepsi) with 3 being no preference. Participants then took an eight question math test to assess their numeracy level (Weller et al., 2012). A copy of the numeracy assessment is available in Appendix C for reference. Both preference and numeracy level were assessed to use in analysis.

Results

The dependent variable of interest is defined as the mean soda difference. The mean soda difference is computed by taking the difference in the subject’s response in question one from his

or her response in question two. For instance, if one subject selected 6 (*very likely to purchase Pepsi/Brand B*) in the first scenario and then 5 (*moderately likely to purchase Pepsi/Brand B*) in the second then his or her soda difference would be 1. The mean soda difference is then computed by taking the average of the differences for all participants. A larger mean soda difference indicates that the participants were more sensitive to the price change whereas a smaller mean soda difference indicates that the participants were not sensitive to the price change. The larger mean soda difference also indicates that participants had a stronger preference for Pepsi (Brand B) in question 1 than they did in question 2. Prior to analysis, subjects were divided into numeracy groups, either in low numeracy or high numeracy. We performed a median split and found that the average numeracy score was between four and five. Subjects who answered zero to four questions correctly were placed in the low numeracy group, while subjects who answered five to eight questions correctly were placed in the high numeracy group. After the median split 225 participants were in the low numeracy group and 199 were in the high numeracy group. The median split was only performed in order to illustrate the results better. During inferential analyses numeracy was treated as a continuous variable.

Before looking at numeracy and preference, we wanted to make sure we were able to replicate the results from Thomas and Morwitz (2005). We looked at the mean soda difference when participants saw 12-packs of soda when there was only a one-digit difference in the prices (\$4.00 vs. \$3.00 in the first choice and versus \$3.60 in the second choice) and compared it to the mean soda difference when there was a two-digit difference in the prices (\$4.00 vs. \$2.99 and \$3.59). Comparison tests revealed that participants in the two-digit difference condition were significantly more sensitive to the price change than participants in the one-digit condition ($M_{two-digit} = .73$ and $M_{one-digit} = .22$, $t(422) = -4.35$ $p < .0001$). These results reflect the same findings

from Thomas & Morwitz (2005). Subjects perceived the difference in prices to be significantly larger when Pepsi (Brand B) was \$2.99 versus when it was \$3.00. Mean values for the conditions appear in Figure 1. After successfully replicating the results from previous research, we were able to examine the influences of numeracy and brand preference on the left-digit effect.

We hypothesized that those who are highly numerate would be able to make better magnitude judgments and not show the left-digit effect. We predicted this because we thought those higher in numeracy would be able to notice that \$2.99 was essentially the same as \$3.00 and that their willingness to purchase would reflect this. Results indicated that this was not the case. We performed an analysis of variance (ANOVA) of the mean soda difference using numeracy, the left-digit difference and their interaction as predictors. Both numeracy and the left-digit difference variables were mean-centered prior to analysis. The comparison tests revealed that the less numerate ($M_{one-digit} = .37$, $M_{two-digit} = .71$) did not significantly differ from the highly numerate ($M_{one-digit} = .08$, $M_{two-digit} = .76$, $p = .26$) in mean soda difference. The digit effect is still significant ($F(1.423) = 18.90$, $p < .0001$) but numeracy itself did not have an influence on the left-digit effect. The mean values for the numeracy conditions are found in Figure 2.

Next, we examined the influence of brand on the left-digit effect. We predicted that when brand names were present, there would be a smaller left-digit effect. We thought that when the brand named product was present, a strong attachment to brand would lead the subject to purchase his or her preferred brand and neglect price differences. We thought the subject would ignore the price and purchase the soft drink he or she normally consumes. Results did not reflect this hypothesis. We performed an ANOVA of the mean soda difference using brand presence, the left-digit difference, and their interaction as predictors. Comparative tests revealed that participants in the no brand condition ($M_{one-digit, no brand} = .38$, $M_{two-digit, no brand} = .80$) did not

significantly differ from the participants in the brand condition ($M_{one-digit,brand} = .09$, $M_{two-digit,brand} = .66$, $p = .52$). The values appear in Figure 3.

This analysis, however, does not show the whole picture because it does not take brand preference into account. Brand preference needs to be considered because of the way the scenario was presented to participants. Coke (Brand A) was always the more expensive option. The participants who prefer Pepsi will always choose Pepsi regardless of the price condition they are in because it is their dominant option. They prefer Pepsi and it is less expensive so they will purchase it every time if they are acting rationally. We performed the identical ANOVA in the previous paragraph, but we ignored the participants who liked Pepsi better as a brand and only looked at those who liked Coke (resulting $n = 220$). Participants who were in the brand name condition ($M_{one-digit,brand} = .03$, $M_{two-digit,brand} = .98$) did not differ significantly from participants in the no brand condition ($M_{one-digit,nobrand} = .31$, $M_{two-digit,nobrand} = .72$, $p = .12$). The left-digit effect was not significantly larger in the brand condition than in the no brand condition. The mean values are found in Figure 4.

Another interesting effect was found when we examined only those participants who liked Coke in the brand-name-present conditions ($n = 125$). We performed an ANOVA of the mean soda difference using the left-digit difference, numeracy, and their interaction as predictors. We hypothesized that more numerate participants would have a smaller mean soda difference than the less numerate when brand was present. Results indicated that there was a significant difference between the more numerate and the less numerate ($F(1,326) = 3.83$, $p = .05$), but in the opposite of the direction hypothesized. The highly numerate who prefer Coke (as a brand rather than the Pepsi brand) paradoxically showed a larger left-digit effect than the less numerate. The means for this two-way interaction appear in Figure 5. Examining the means

among the highly numerate only, the results indicated a significant effect of the left-digit difference ($F(1,165) = 4.88, p = .03$); the difference was not significant among the less numerate.

Discussion

The present study was designed to test whether or not numeracy and/or brand preference influenced the left-digit effect, and in turn consumer's willingness to purchase goods. We predicted that people who are more numerate would make better magnitude judgments and not be affected by the left-digit effect. The more numerate would be better price discriminators and realize that \$2.99 is essentially \$3.00. This would lead them to be less sensitive to price changes and to treat the distance between \$4.00 and \$2.99 to be practically equivalent to the distance between \$4.00 and \$3.00. In contrast, we predicted that the less numerate would have difficulty with the task and would show a large left-digit effect. The less numerate do not perform well in the realm of numbers and would think of \$2.99 as being closer to \$2.00 instead of \$3.00. The less numerate would be more sensitive to the price differences and would be far more likely to switch their preferences as the price changes from \$2.99 in the first scenario to \$3.59 in the second scenario. This is because they would judge the prices in the second scenario to be significantly closer together than in the first scenario. In addition to the numeracy effect, we predicted that the left-digit effect would be smaller when brand name products are present and the participant has a strong preference for that brand. When a participant has a strong brand preference and it is something that he or she regularly purchases, then it is possible to suspect that the participant would ignore the price difference and would purchase his or her preferred brand. This would lead to a smaller left-digit effect because the consumer is ignoring the price change and is purchasing based on his or her preferences alone.

The results in the present study did not support our hypotheses. Overall, there was no significant main effect of numeracy on the left-digit effect. The more numerate did not show a smaller left-digit effect compared to the less numerate. Participants who were more numerate and had a strong preference for Coke paradoxically showed a larger left-digit effect than the less numerate. The more numerate individuals did not behave consistently with previous research on numeracy (e.g. Peters et al., 2006; Dieckmann, Slovic, & Peters, 2009; Peters & Dieckmann et al., 2009). Previous research suggests that when presented with numerical information, more numerate individuals interpret data and more likely to transform numbers from the given format to other formats better than the less numerate (Peters et al., 2006). For example, Zikmund-Fisher et al. (2008) conducted a study on subjective numeracy and comprehension of information presented in different graphical displays. The information presented to participants was related to cancer survivor rates related to various forms of treatment. Individuals higher in numeracy had better comprehension of the numerical information presented in the graphical displays than the less numerate (Zikmund-Fisher et al., 2008). Dieckmann, Slovic and Peters (2009) explored how individuals evaluate data when they are given both narrative and numerical information. The less numerate individuals relied more heavily on narrative evidence and less on numerical information whereas the more numerate behaved in the opposite manner (Dieckmann, Slovic, & Peters, 2009). Peters et al. (2006) showed that the more numerate, who are better able to transform probabilities, perform better on judgment tasks. Additionally, Peters et al. (2006) showed that the less numerate do not have the ability to comprehend numerical information at the same level as the more numerate. The less numerate are also influenced by non-numerical sources and affective rich information (Peters et al., 2006). These studies related to numeracy all show that the more numerate interpret numerical information and understand it better and

transform it more than the less numerate and make better judgments in these situations. The present study is similar to these studies in the fact that participants were presented with both numerical information (the price of the sodas) and affective information (brand).

In contrast, the present study differs from previous research in that the more numerate do not make better judgments when presented with numerical information and show a larger left-digit effect. This may be due to random sampling and we happened to get a sample where the more numerate behave in a suboptimal manner. If the results from the present study were not due to a random sample, one explanation is that the more numerate played around with the numbers too much in their head. When evaluating the prices, the more numerate could have focused too heavily on the left-digit and ignored the rest of the price. Thus, they did not make the transformation speculated about in Peters et al. (2006). An interesting follow up study would be to use an eye-tracking device to determine what the more numerate look at when making a purchase decision (i.e. just the left digit or the right digits also). A second explanation for the more numerate showing a larger left-digit effect could be that the less numerate ignored the prices altogether. The less numerate may make their purchase decisions based solely on brand preference. If this were the case, the less numerate would purchase Coke or Pepsi regardless of the price and would not be influenced by the left-digit of the price. This would also be interesting to study with an eye-tracking device to see if the less numerate are only looking at the product and ignore the price when making a purchase decision.

We were also incorrect with our hypothesis regarding the influence of brand. There was not a significantly smaller left-digit effect when brand name products were used (Coke and Pepsi) versus when they were not (Brand A and Brand B). There was a nonsignificant tendency

for participants to show a larger left-digit effect in the opposite direction as originally hypothesized.

Although the present study shows the more numerate behaving in the opposite way that previous research would predict, it still shows that numeracy plays an important role in decision making. People differing in numeracy use numerical information differently when making judgments. The present study demonstrates that more numerate individuals can use numerical information in a suboptimal manner and contrary to previous research. The present study also has important implications in pricing practices. If a brand has strong recognition, such as Coke and Pepsi, the company can get away with pricing its products a few cents higher. People who had a strong preference for Coke were still likely to purchase Coke when it was \$4.00 and Pepsi was \$3.59 or \$3.60. This shows that Coke does not have to be priced exactly the same as Pepsi for consumers to purchase Coke even though some view Coke and Pepsi as substitute goods. This means Coke can get away with making their product a few cents higher, which when sold in large quantities will lead to much higher profits.

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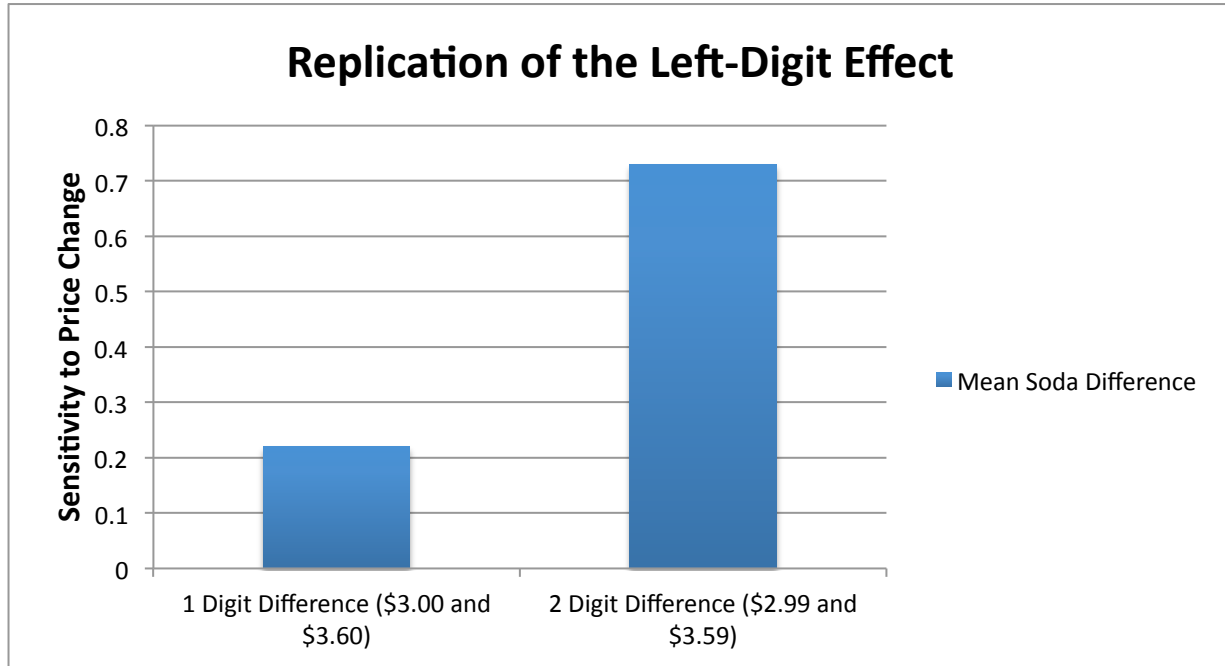
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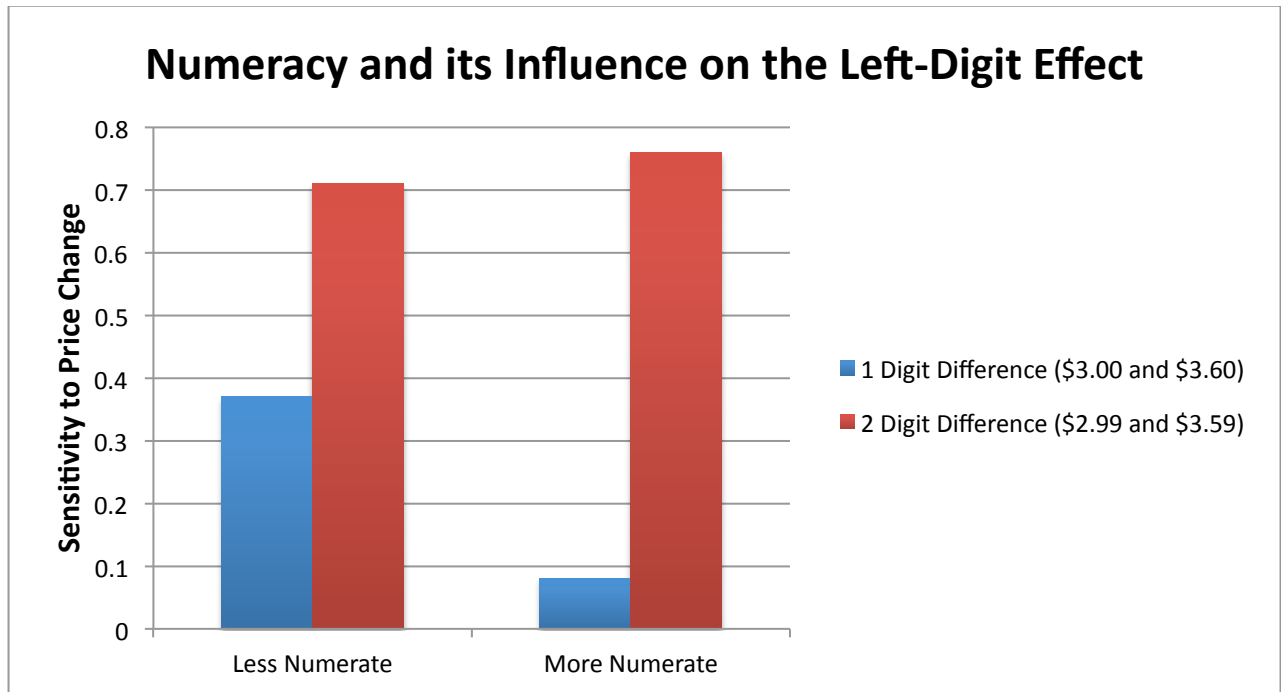
Figure 1.



Mean Soda Difference when prices are 1 digit different (\$4.00 and \$3.00) and 2 digits different (\$2.99 and \$4.00)

Figure 1. Mean Soda Difference across different conditions. There was a significant difference between the two groups. The y-axis shows the sensitivity of the participants to the price change. A larger value means that the participant was more likely to purchase Pepsi (Brand B) in the first grocery store than they were in the second grocery store. Participants who saw sodas with only one digit difference in price were significantly less sensitive to the price change compared to participants in the two-digit difference condition.

Figure 2.



Numeracy

Figure 2. There is no significant main effect of numeracy on the left-digit effect. The more numerate do not show a smaller left-digit effect compared to the less numerate. The digit effect is still significant ($p < .0001$) but numeracy is not ($p = .26$).

Figure 3.

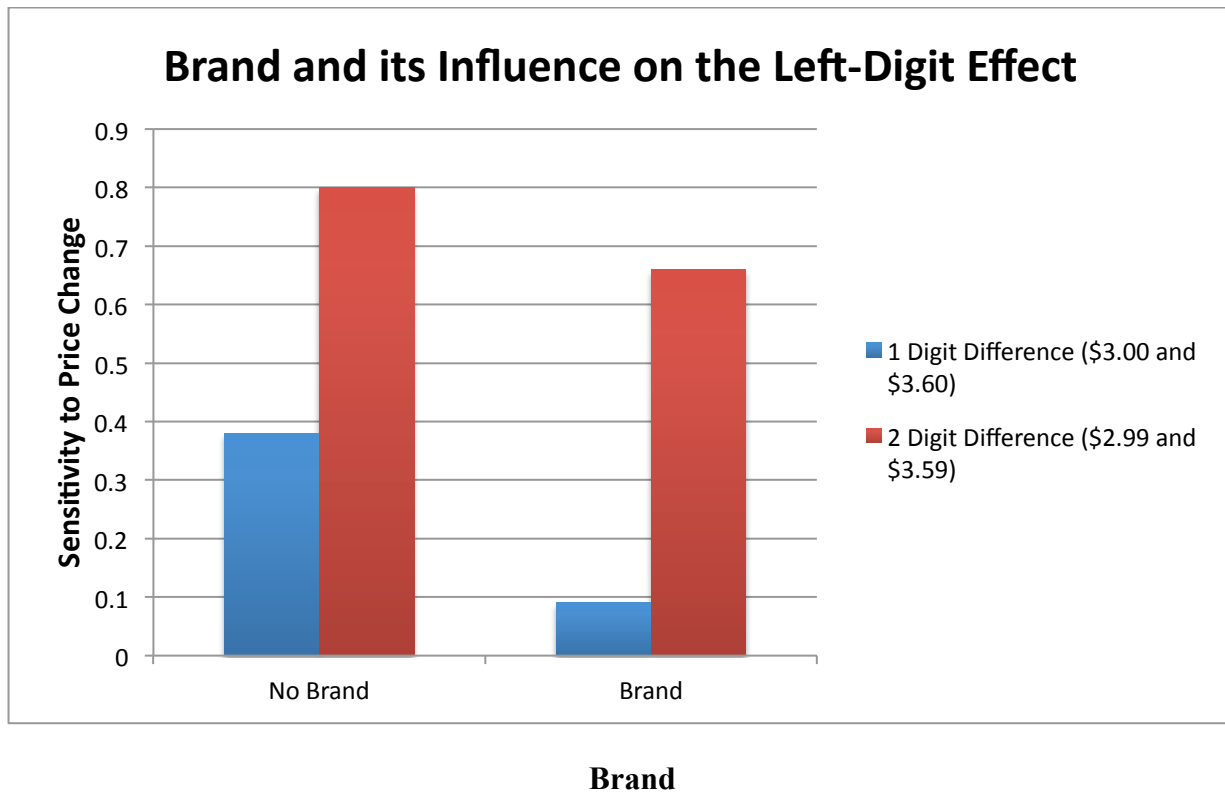
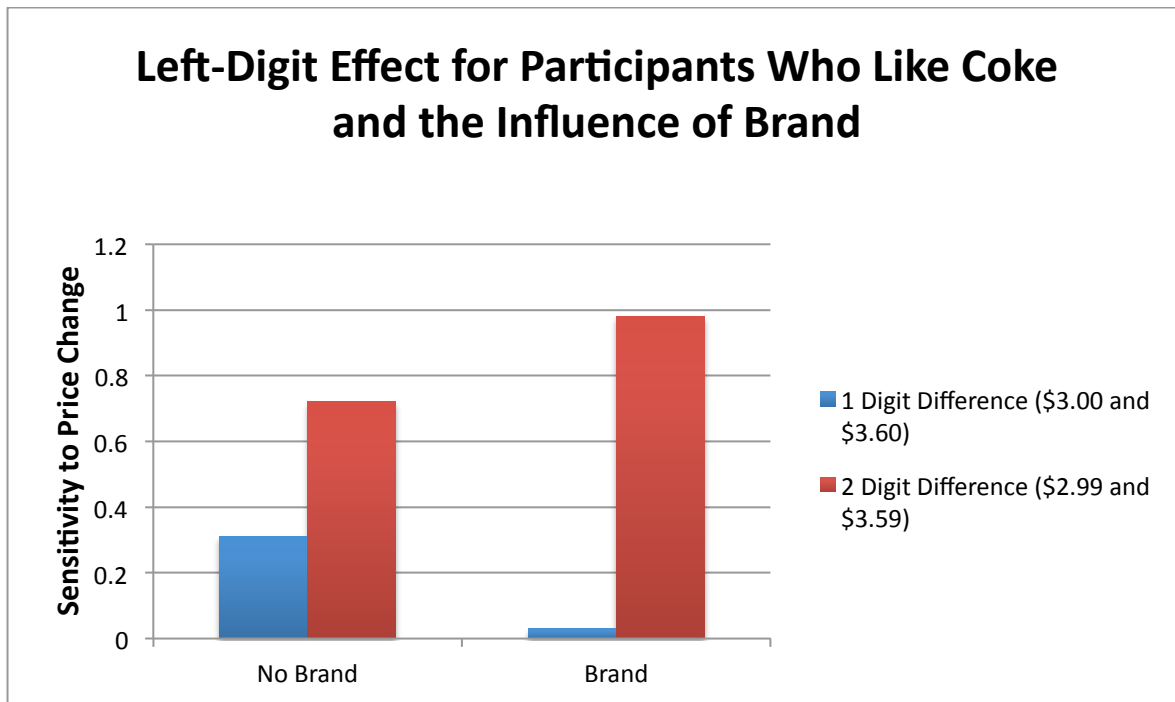


Figure 3. There is no significant difference in the left-digit effect when brand is present versus when it is not. This does not reflect the whole picture because preference is not taken into account. This can be found in Figure 4.

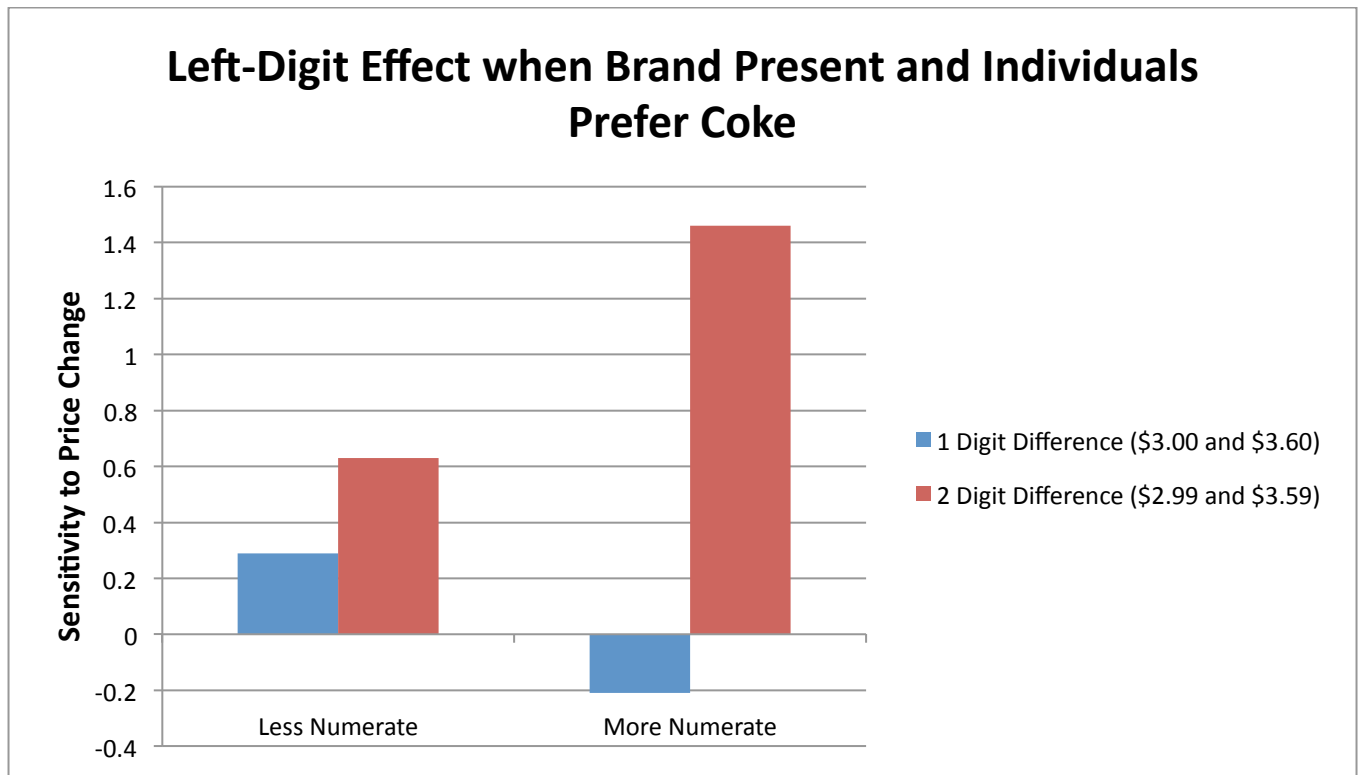
Figure 4.



Influence of brand when participants like Coke

Figure 4. The participants who like Pepsi were left out of this analysis. Individuals who like Pepsi do not show the left-digit effect when brand is present because Pepsi is always less expensive than Coke so they have a dominant option. Because they like Pepsi more than Coke and Pepsi is cheaper, they will purchase Pepsi every time regardless if there is a one-digit difference or a two-digit difference in the price. When looking at just people who like Coke there is still not a significant effect of brand on the left-digit effect. The left-digit effect is not significantly larger when brand name is present versus when it is not ($p = .12$).

Figure 5.



Numeracy, Brand and Preference

Figure 5. More numerate individuals who like Coke and when brand is shown paradoxically show a larger left-digit effect than the less numerate. The effect is significant ($p = .05$) and the effect is in the direction showing that more numerate are behaving inconsistently with previous research.

Appendix A

Situation presented to participants in brand, two-digit difference condition.

Imagine that you are at the grocery store walking down the soda aisle. You notice 12-packs of Coke and Pepsi. Their prices are listed below. If you were to buy a 12-pack of soda, would you be more likely to purchase Coke or Pepsi? Please indicate your response on the scale below.



\$4.00



\$2.99

Very likely to
purchase Coke



Moderately likely
to purchase Coke



Slightly likely to
purchase Coke



Slightly likely to
purchase Pepsi



Moderately likely
to purchase Pepsi



Very likely to
purchase Pepsi



Now imagine that you are at a different grocery store walking down the soda aisle. You notice 12-packs of Coke and Pepsi. Their prices are listed below. If you were to buy a 12-pack of soda, would you be more likely to purchase Coke or Pepsi? Please indicate your response on the scale below.



\$4.00



\$3.59

Very likely to
purchase Coke



Moderately likely to
purchase Coke



Slightly likely to
purchase Coke



Slightly likely to
purchase Pepsi



Moderately likely to
purchase Pepsi



Very likely to
purchase Pepsi



Situation presented to participants in brand, two-digit difference condition.

Imagine that you are at the grocery store walking down the soda aisle. You notice 12-packs of Coke and Pepsi. Their prices are listed below. If you were to buy a 12-pack of soda, would you be more likely to purchase Coke or Pepsi? Please indicate your response on the scale below.



\$4.00



\$3.00

Very likely to
purchase Coke



Moderately likely to
purchase Coke



Slightly likely to
purchase Coke



Slightly likely to
purchase Pepsi



Moderately likely to
purchase Pepsi



Very likely to
purchase Pepsi



Now imagine that you are at a different grocery store walking down the soda aisle. You notice 12-packs of Coke and Pepsi. Their prices are listed below. If you were to buy a 12-pack of soda, would you be more likely to purchase Coke or Pepsi? Please indicate your response on the scale below.



\$4.00



\$3.60

Very likely to
purchase Coke



Moderately likely to
purchase Coke



Slightly likely to
purchase Coke



Slightly likely to
purchase Pepsi



Moderately likely to
purchase Pepsi



Very likely to
purchase Pepsi



Situation presented to participants in no brand, two-digit difference condition.

Imagine that you are at the grocery store walking down the soda aisle. You notice 12-packs of Soda Brand A and Soda Brand B. Their prices are listed below. If you were to buy a 12-pack of soda, would you be more likely to purchase Soda Brand A or Soda Brand B? Please indicate your response on the scale below.

Soda Brand A

\$4.00

Very likely to
purchase
Soda Brand A



Moderately likely to
purchase
Soda Brand A



Slightly likely to
purchase
Soda Brand A



Slightly likely to
purchase
Soda Brand B



Moderately likely to
purchase
Soda Brand B



Very likely to
purchase
Soda Brand B



Soda Brand B

\$2.99

Now imagine that you are at a different grocery store walking down the soda aisle. You notice 12-packs of Soda Brand A and Soda Brand B. Their prices are listed below. If you were to buy a 12-pack of soda, would you be more likely to purchase Soda Brand A or Soda Brand B? Please indicate your response on the scale below.

Soda Brand A

\$4.00

Very likely to
purchase
Soda Brand A



Moderately likely to
purchase
Soda Brand A



Slightly likely to
purchase
Soda Brand A



Slightly likely to
purchase
Soda Brand B



Moderately likely to
purchase
Soda Brand B



Very likely to
purchase
Soda Brand B



Soda Brand B

\$3.59

Situation presented to participants in no brand, one-digit difference condition.

Imagine that you are at the grocery store walking down the soda aisle. You notice 12-packs of Soda Brand A and Soda Brand B. Their prices are listed below. If you were to buy a 12-pack of soda, would you be more likely to purchase Soda Brand A or Soda Brand B? Please indicate your response on the scale below.

Soda Brand A

\$4.00

Soda Brand B

\$3.00

Very likely to
purchase
Soda Brand A



Moderately likely to
purchase
Soda Brand A



Slightly likely to
purchase
Soda Brand A



Slightly likely to
purchase
Soda Brand B



Moderately likely to
purchase
Soda Brand B



Very likely to
purchase
Soda Brand B



Now imagine that you are at a different grocery store walking down the soda aisle. You notice 12-packs of Soda Brand A and Soda Brand B. Their prices are listed below. If you were to buy a 12-pack of soda, would you be more likely to purchase Soda Brand A or Soda Brand B? Please indicate your response on the scale below.

Soda Brand A

\$4.00

Soda Brand B

\$3.60

Very likely to
purchase
Soda Brand A



Moderately likely to
purchase
Soda Brand A



Slightly likely to
purchase
Soda Brand A



Slightly likely to
purchase
Soda Brand B



Moderately likely to
purchase
Soda Brand B



Very likely to
purchase
Soda Brand B



Appendix B

List of filler questions after original task and before the numeracy measure.

1. On average, how many cans/servings of soda do you drink per week?
2. Do you do your own grocery shopping?
3. If you had to choose, which brand of soda do you typically prefer? (assuming they are priced the same and both are readily available)

Extremely prefer
Coke



Slightly Prefer
Coke



No Preference



Slightly prefer
Pepsi



Extremely prefer
Pepsi



Appendix C

Measure used to assess numeracy

1. Imagine that we roll a fair, six-sided die 1,000 times. Out of 1,000 rolls, how many times do you think the die would come up as an even number?
2. In the BIG BUCKS LOTTERY, the chances of winning a \$10.00 prize are 1%. What is your best guess about how many people would win a \$10.00 prize if 1,000 people each buy a single ticket from BIG BUCKS?
3. In the ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What percent of tickets of ACME PUBLISHING SWEEPSTAKES win a car?
4. If the chance of getting a disease is 10%, how many people would be expected to get the disease out of 1,000?
5. If the chance of getting a disease is 20 out of 100, this would be the same as having a ____% chance of getting the disease.
6. Suppose you have a close friend who has a lump in her breast and must have a mammogram. Of 100 women like her, 10 of them actually have a malignant tumor and 90 of them do not. Of the 10 women who actually have a tumor, the mammogram indicates correctly that 9 of them have a tumor and indicates incorrectly that 1 of them does not have a tumor. Of the 90 women who do not have a tumor, the mammogram indicates correctly that 81 of them do not have a tumor and indicates incorrectly that 9 of them do have a tumor. The table below summarizes all of this information. Imagine that your friend tests positive (as if she had a tumor), what is the likelihood that she actually has a tumor?

	Tested Positive	Tested Negative	Total
Actually Has a Tumor	9	1	10
Does Not Have a Tumor	9	81	90
Total	18	82	100

(Answer: _____ out of _____)

7. A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost?
8. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take to cover half of the lake?